

Land Mollusca from Four Islands of the Three Kings Group: With Descriptions of Three New Species.

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In this, my third contribution on the land mollusca of the Three Kings Islands, a presumed moderately complete census of species, distributed on the four forested islands of the group, is presented.

Satisfactory samples of leaf mould were obtained from all four islands and a fairly thorough search for macro-fauna was made on Great Island and North East Island and to a lesser extent on West and South West Islands.

The land molluscan fauna of Great Island is best known, since I have personally collected there on three occasions, including one visit of five days' duration.

Including subspecies, the total of land mollusca for the group now stands at 24, and they are distributed thus:

	No. of species.	Endemic	On one other Id.	On two others.	On all 4.
Great Island	19***	7	7*	1	3*
North East Island	11*	0	6	2	3*
South West Island	11**	1	5	5	3*
West Island	8*	0	2	3	4*

Only three of the twenty-four species and subspecies are found on the mainland: *Tornatellinops novoseelandica* (Pfr.), *Paralaoma lateumbilicata* (Suter), and *Delos* cf. *jeffreysiana* (Pfr.). The asterisks denote the number of these mainland species present.

The following table shows the number of species common to the indicated brackets of islands. The asterisks have the same significance as above.

Great Island + N.E.	9*	North East Id. + W.	7*
Great Island + S.W.	8**	North East Id. + S.W.	6*
Great Island + W.	4*	North East + W. + S.W.	4*
Great Island + N.E. + W.	4*	South West + W.	3*
Great Island + N.E. + W. + S.W.	3*	On all four islands	3*

LIST OF LAND MOLLUSCA.

	GREAT ISLAND					N.E.	SOUTH WEST ID.				WEST ID.	
	A	B	C	D	E	F	G	H	I	J	K	L
MACROFAUNA:												
<i>Placostylus b. bollonsi</i> Suter	*T	*				*						
„ <i>b. bollonsi</i> Form A.											*	*
„ <i>b. arbutus</i> Powell					*T							
„ <i>b. coperatus</i> Powell				*T								
<i>Rhytida (Rhytidarex)</i> <i>buddlei</i> Powell							*T					
<i>Rhytida (Rhytidarex)</i> <i>johsoni</i> Powell						*T					*	*
<i>Allodiscus cassandra</i> (Hutton)	*T	*	*			*					*	
„ <i>turbotti</i> Powell					*T	*						
MICROFAUNA:												
<i>Murdochia annectens</i> Powell		T										
„ <i>filicosta</i> Powell						90.T	125	159	28	4	82	208
„ <i>solutaria</i> Powell	1.T	3			9							
„ <i>hirsutissima</i> n. sp.					5.T							
<i>Therasiella pectinifera</i> Powell	T	8			8	10		2	32			
<i>Egestula gaza</i> (Suter)	T	27	*		16		2	6				
<i>Mocella manawatawhia</i> Powell	T	1		11	2	*		1			1	6
<i>Laoma labyrinthica</i> Powell		41.T			2		158	56	333	1		
<i>Phrixgnathus subariel</i> Powell						24.T					44	158
„ <i>blacki</i> n. sp.					2.T							
* <i>Paralaoma latumbilicata</i> (Suter)					262		338	37	72	1		
„ <i>regia</i> Powell				172	34	54.T				2	214	365
„ <i>turbotti</i> Powell		2.T			1		40		78.T			
„ <i>buddlei</i> n. sp.												
<i>Laomarex sericea</i> Powell						5.T	78		4	13		
* <i>Delos cf. jeffreysiana</i> (Pfr.)					4							
* <i>Tornatellinops</i> <i>novoseelandica</i> (Pfr.)		1		5	3	*	21		2	4	38	121
Number of species	6	10	2	4	15	11	8	6	7	6	8	7
Number of specimens (Microfauna only)		84		188	348	183	762	261	649	25	379	858

* Widely distributed on the mainland also. T = type locality.

The numbers of specimens are inserted as a very rough guide to the frequency of occurrence of the species, but the results are not accurate enough to be termed quantitative. The samples varied in bulk from a 25lb flour bag in samples D, E, and I to about one tenth that amount in samples K. and L. Some samples, I for instance, consisted largely of coarse unproductive debris such as whole puka leaves and large twigs. On the other hand, relatively small samples of humus, F, K and L for example, were phenomenally rich.

LIST OF LEAF MOULD SAMPLES.

A. Great Island. South East Bay and landing slope to vicinity of Provision Depot. A small sample of leaf mould, "Will Watch" Expedition, A. W. B. Powell, Feb., 1934.

B. Great Island. Below rock face, N.E. of Provision Depot. "Arbutus" Expedition, A. W. B. Powell, Dec., 1945, and E. G. Turbott,

- C. Great Island.** Kanuka forest in depot stream valley. "Arbutus" Expedition, A. W. B. Powell, Dec., 1945. Specimens collected in situ.
- D. Great Island.** North West Landing slope in stunted ngaio scrub at ca. 500 feet. Site of *Placostylus bollonsi caperatus* colony. "Ocean Star" Expedition, E. G. Turbott, 15:1:1951.
- E. Great Island.** South West coast, ca. 700 feet. Site of *Placostylus bollonsi arbutus* colony. "Alert" Expedition, A. W. B. Powell, 6:10:1948. Leaf mould from between large boulders in an undisturbed area under *Paratrophis smithii* and *Brachyglottis arborescens*.
- F. North East Island.** Leaf mould from marginal areas of puka forest, Major G. A. Buddle, Jan., 1948.
- G. South West Island.** Leaf mould from varied locations. Major G. A. Buddle, March, 1949.
- H. South West Island.** Leaf mould from varied locations, Dr. G. T. S. Baylis, March, 1950.
- I. South West Island.** Leaf mould from puka forest on summit ridge, "Ocean Star" Expedition, E. G. Turbott, 13:1:1951.
- J. South West Island.** Half way up eastern slope under small grove of puka and kanuka, surrounded by scrub. "Ocean Star" Expedition, E. G. Turbott, 13:1:1951.
- K. West Island.** Leaf mould from varied locations. Major M. E. Johnson, Jan., 1950.
- L. West Island.** Leaf mould from varied locations. Major M. E. Johnson, Jan., 1951.

ACKNOWLEDGMENTS.

I am deeply indebted to the gentlemen referred to above, who have at the expense of valuable time that could have been devoted entirely to their own interests, generously collected samples and made observations on my behalf.

DISTRIBUTION OF SPECIES.

The distributional results show a high degree of endemism for Great Island, which is to be expected since it is the largest and highest island of the group and the only one with permanent water.

The few endemics from the three smaller islands, none on North East and West Islands respectively and one on South West Island, points to a fairly recent severing of these islands from the larger mass, Great Island.

From a manuscript by Dr. G. T. S. Baylis on the vegetation of South West and West Islands, I have been given permission to quote some of his observations that have a bearing upon the distribution of snail communities. This may be summarised briefly:

Great Island. Vegetation greatly modified. Induced dominance of kanuka (*Leptospermum ericoides*) brought about by several centuries of Maori occupation followed by a considerable population of goats for over half a century. (See also Baylis and Turbott, Rec. Auck. Inst.

Mus. 3 (4 & 5), pp. 239-252 and 253-272.) The puka (*Meryta sinclairii*), absent during the goat infestation, has reappeared since their extermination in 1946.

North East Island. Induced dominance of the puka (*Meryta sinclairii*), probably resultant from Maori agricultural activities, of which there is plenty of evidence.

South West Island. The dominant puka canopy again suggests that the forest cover is not natural but seral, although evidence of former Maori occupation is not evident. Reduction in the occurrence of two species of tea-tree (*Leptospermum*) to a single example of *L. ericoides*, on the southern end, was noted. This is of significance in respect to the occurrence of the snail *Egestula gaza* (see later).

West Island. The vegetation suggests a climax condition. It is a mixed forest with puka as one of the rarer trees in the assemblage. There is evidence of Maori visitation, but not occupation. Of the four forested islands Dr. Baylis considers West Island alone to be in a natural state.

THE MACROFAUNA.

Placostylus bollonsi. This and two subspecies occur on Great Island. The typical species is abundant on North East Island and was probably intentionally or accidentally transported there by the Maoris from Great Island. No *Placostylus* has been located on South West Island, but much of the island remains to be searched, particularly the western slope. If an intensive search fails to reveal *Placostylus* on South West Island it may be significant that this, the only island of the four without *Placostylus*, is the one without evidence of Maori occupation or visitation, and a different solution of the puka dominance on that island will require to be advanced. South West Island and North East Island both have a dominant cover of puka, and conditions appear similar except that South West is the dryer island. On West Island a small form of *Placostylus bollonsi* is abundant.

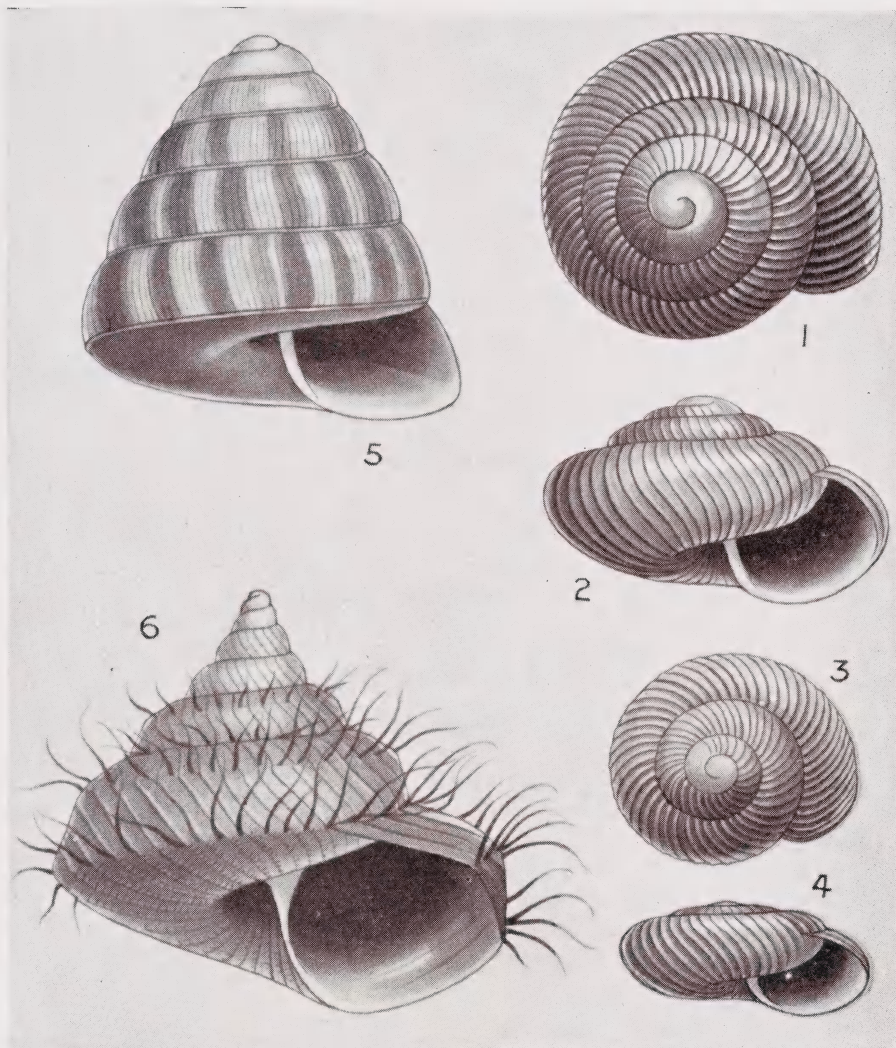
Rhytida (Rhytidarex) johnstoni and *buddlei*. The former occurs on both North East and West Islands and the latter only on South West Island. No *Rhytida* has been found on Great Island. If *Placostylus* survived the modifications to the Great Island flora then *Rhytida*, if it was ever present, should have survived also.

Allodiscus cassandra. Found abundantly on Great Island, North East Island, and on West Island (one dead shell). It may have been carried from one island to another by Maoris.

THE MICROFAUNA.

Egestula gaza. This is the abundant snail throughout the kanuka scrub and forest of Great Island. A very few examples came from leaf mould taken representatively over South West Island, but it is apparently absent from both North East and West Islands.

It would appear that since *Egestula gaza* shows a marked preference for the rather acid condition and poor humus associated with kanuka, the present abundance of the species on Great Island is entirely resultant from the induced dominance of kanuka occasioned by the combined factors of human occupation and browsing activities of goats,



Figs. 1 & 2: *Paralaoma buddlei* n. sp. 1.4 mm. x 2.15 mm. South West Island. Holotype.

Figs. 3 & 4: *Paralaoma regia* Powell, 1948. 0.85 mm. x 1.7 mm. North East Island. Holotype.

Fig. 5: *Phrixgnathus blacki* n. sp. 1.9 mm. x 1.8 mm. Great Island (Holotype).

Fig. 6: *Murdochia hirsutissima* n. sp. 5.6 mm. x 6.0 mm. Great Island (Holotype).

which gave the unpalatable kanuka its chance to spread. This suggests that *Egestula gaza* under natural conditions was a rare local on Great Island just as it is today on South West Island.

It is of interest to note that the species is entirely lacking from the puka forest of the summit ridge on South West Island and its occurrence there must be in marginal scrub. Since Baylis infers a reduction of *Leptospermum* on South West Island to a minimum since Cheeseman's visit in 1889, the scarcity of this snail there can be accounted for.

Future observation on Great Island should show a reduction in the numbers of this snail as the kanuka loses dominance with the development of mixed forest.

Mocella manawatawhia. Living examples of this snail were found only under *ngaio* (*Myoporum laetum*) on the site of the *Placostylus bollonsi caperatus* colony, North West landing slope, Great Island. It is noteworthy that *Egestula gaza* was absent from this location, probably because of extreme dryness since some kanuka was present.

Murdochia filicosta. This is one of the most abundant snails of the puka forest on North East, West, and South West Islands. It has a near relative in the scarce and extremely local *M. annectens* from Great Island. The latter was probably a dominant on Great Island when the original cover included puka. The development of three scarce local species of *Murdochia* on Great Island is probably resultant from isolation in original forest remnants.

The remaining items of the microfauna show a curious haphazard distribution among the four islands and no useful evidence is apparent that suggests any particular linking sequence between the islands.

SYSTEMATIC.

Placostylus (Basileostylus) bollonsi Suter, 1908. Form A.

The race of *bollonsi* from West Island averages a slightly smaller adult size than for the typical subspecies from the South East Landing, Great Island. The epidermis is thinner, of a paler shade of light brown and the aperture tends to be less capacious. These differences, however, are too slight to warrant a new subspecific nomination for the West Island form. The North East Island colony is indistinguishable from the typical species. Since marked subspeciation in *bollonsi* is apparent only on Great Island, it is assumed that both the West Island and North East Island occurrences are resultant from Maori visitations and that in respect to the West Island colony a slightly stunted ecological variant is developing in response to the more exposed nature of the habitat.

Dimensions and other features of ten examples of the West Island form, for comparison with the tables given in my 1948 paper (Powell, 1948, pp. 286-287) :

Ht. (mm.)	Diam. (mm.)	Spire ratio.	Spire angle.
77.50	35.00	2.28	33°
84.00	35.00	2.44	37°
84.50	35.00	2.36	34°
85.00	36.00	2.36	34°
85.00	36.00	2.43	37°
85.00	36.00	2.36	35°
85.00	36.00	2.43	36°
86.00	37.50	2.32	35°
87.00	39.00	2.37	35°
87.50	37.50	2.36	36°

The largest example measured 90.5 mm. x 37.5 mm. with an aperture to spire ratio of 2.43 and a spire angle of only 28°. This specimen is abnormally elongated, due to an injury at the second post-nuclear whorl, and has been ignored on this account.

The egg, as with those from Great Island, is exceedingly variable in size and shape: 17.5 mm. x 11.75 mm.; 16.0 mm. x 11.5 mm., and 14.00 mm. x 11.75 mm.

The embryo shows an elongated tendency as in that of *bollonsi arbutus* and *bollonsi caperatus*.

All other characteristics are identical with those of the typical species.

Locality: West Island, Three Kings Group. Abundant over most wooded parts of the Island.

Major Johnson, on his second visit in January, 1951, at my request, endeavoured to include in his collecting the largest examples obtainable. That the West Island race is constantly smaller is thus substantiated.

Average measurements of all the *bollonsi* colonies for comparison with the West Island form:

<i>bollonsi bollonsi</i>	Ht. (mm.)	Diam. (mm.)	Spire ratio.	Spire angle.
S.E. landing, Great Island (type loc.)	91.65	37.15	2.33	36
N. of S.E. landing, Great Is.	94.75	38.70	2.35	36.8
North East Island	95.67	39.55	2.29	42.4
West Island (Form A)	84.65	36.30	2.37	35.2
<i>bollonsi caperatus</i>				
N.W. landing, Great Island (type loc.)	90.20	34.60	2.52	35.3
<i>bollonsi arbutus</i>				
S.W. of Great Is. (type loc.)	108.40	41.45	2.47	32.4
Hapuka Point	97.85	37.15	2.47	32.6

(The average is of ten examples in every case.)

Murdochia hirsutissima n. sp. Pl. 27, fig. 6.

Shell large for the genus, trochiform, umbilicated, with tall, narrowly conical early whorls but rapidly expanded over the last three whorls, which bear complicated epidermal structures produced at the periphery and the middle of the whorls into very long flexuous hair-like processes. Whorls 7½, including a small papillate protoconch of two smooth whorls. Following two whorls narrowly conical and sculptured with numerous retractively arcuate somewhat irregular epidermal axial folds. Remaining three whorls rapidly expanding and biangulate, one angle at the middle of the whorls and the other sutural, which renders the body-whorl sharply carinate. Both angles bear long hirsute processes, those on the middle angle being the longer and more erect than those at the suture which on the spire whorls tend to lie flat against the succeeding whorl. There are about 50 primary radials on the body whorl and most of them bear processes although many are shed or damaged. There are several weaker radials in each interspace that do not develop processes. On the base, all of the primary radials bear dense short backwardly directed bristles. Umbilicus deep, about one seventh major diameter of base. Colour golden-brown, with the early post-nuclear whorls and the longer processes darker brown.

Height, 5.6 mm.; diameter, 6.0 mm. (holotype).

Locality: Great Island, South West coast, ca. 700 feet; site of *Placostylus bollonsi arbutus* colony, in leaf mould amongst large boulders, under *Paratrophis* and *Brachyglottis*; A.W.B.P., "Alert" Expedition, 6:10:1948.

Holotype and paratypes in Auckland Museum

Phrixgnathus blacki n. sp. Pl. 27, fig. 5.

Shell small, elevated-conic, perforate, with keeled periphery. Surface smooth and shining with a distinct regular radial pattern in reddish-brown on a light horn-coloured ground. Whorls $6\frac{1}{2}$, including a low dome-shaped, smooth, colourless protoconch. Spire whorls lightly convex with deeply channelled supra-margined suture. Body-whorl sharply keeled at the periphery and bearing a narrow rounded spiral cord. Surface sculpture of dense concavely arcuate radial riblets, about 30 per mm. Umbilicus narrow and deep, about one tenth diameter of base which is sculptured with subobsolete dense radials and spirals. Colour pattern of clear cut radials, 14-20 per whorl, with interspaces approximately equal to the width of the radials. Base devoid of colour pattern.

Height, 1.9 mm.; diameter, 1.8 mm.

Locality: Great Island, South West coast, ca. 700 feet; site of *Placostylus bollonsi arbutus* colony, in leaf mould amongst large boulders under *Paratrophis* and *Brachyglottis*; A.W.B.P., "Alert" Expedition, 6:10:1948.

Holotype: In Auckland Museum.

The species is nearest allied to *P. erigone* Gray, from which it is at once distinguished by the supra-margined suture, rib margined periphery and clear cut reddish-brown radial pattern recalling that of *Laoma labyrinthica* Powell, which it somewhat resembles in size and shape.

Paralaoma buddlei n. sp. Pl. 27, figs. 1, 2.

Shell small, depressed turbinata, widely umbilicated, finely radially costate, thin, shining, dark horn coloured. Spire equal to height of aperture. Body-whorl with narrowly rounded periphery very slightly above the middle. Whorls $4\frac{1}{2}$, regularly and slowly increasing, including smooth protoconch of $1\frac{1}{2}$ whorls. Suture deeply impressed. Post-nuclear sculpture of numerous crisp retractively arcuate, somewhat irregular, radial ribs, approximately 48 on the penultimate whorl and 60 on the last whorl. Interstices reticulated with microscopic radial threads crossed by numerous spiral lirae. Umbilicus about one fourth major diameter of the base.

Major diam., 2.15 mm.; minimum diam., 1.9 mm.; height, 1.4 mm. (holotype).

Locality: South West Island, in leaf mould in the puka forest on the summit ridge. E. G. Turbott, 13:1:1951. "Ocean Star" Expedition.

Holotype and many paratypes in Auckland Museum.

The species is similar to *regia* in sculptural detail, but has a higher spire, more numerous axials, is darker coloured, and attains a larger size. Named after the late Major G. A. Buddle, D.S.O., whose keen interest in the fauna of the Three Kings Islands has resulted in the finding of several new species of mollusca.

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